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them together. But considering that the Nerves are commonly cover'd with fatty Particles, I concluded that these Apertures were no Vessels, but meer fatty Particles, which I found to be true when I had cut thro' them, and discover'd that the inward Fat was eaten out by the Mites, which had left only the Husks, or *Cortices*, of the Fat Globules behind: Which *Cortices* I never had as yet been able to discover, because the *Cortices* of the Fat Globules would, upon any heat, melt away as fast as the inward Fat.

III. *Observations upon the Vessels in several sorts of Wood, and upon the Muscular Fibres of different Animals. By the same Curious and Inquisitive Person.*

Delft, Jan. 24. 1721.

SEEING some reddish Boards carry'd into a House in my Neighbourhood, and enquiring what use they were design'd for, I was answer'd that they were bought of the *India* Company to make Cabinets of, and that they came from the Island *Amboina*.

I procured a piece of that Wood saw'd off at the end of a Board, as likewise some of the Chips, in order to observe the Vessels therein; and, cutting the Wood through all manner of ways, I found that in one place the Wood appear'd whitish, that at a small distance

distance it was red, and in another place blackish. Upon cutting it transversely, I saw the Orifices of the ascending Vessels, which ran along the length of the Wood, and which appear'd of such a size in the Microscope, that one would have judg'd a Pea might pass thro' them. Where the Wood look'd reddish, I found these great Vessels fill'd with a Substance of a fine red colour, so that I imagin'd, that these great Vessels carried a red Sap into the Horizontal Vessels, which appear'd so very numerous, and so thick together, that they caus'd the Wood to appear of the same colour with the red Substance, which was contain'd in those Vessels likewise.

I afterwards cut off some very thin slices transversely from this Wood, and putting them into a *China* Cup, I pour'd some hot Water upon them, and suffer'd them to lie in it for some time; then viewing them with a Microscope, I observ'd that the red Substance was extracted by the Water, and no red colour was now to be found in any of the Vessels.

What seem'd the strangest to me in this Wood, was that cutting thro' the Wood lengthways, as I frequently did, I observ'd it to be of a fine red colour for one Hair's breadth, and a Hair's breadth farther it appear'd white; and the ascending Vessels seem'd to be smaller, where the Wood was red, than where it was white: which narrowness of the red Vessels I judg'd to proceed from the Sap contain'd in them.

I made several other Remarks upon this Wood, which I shall pass by at this time, and shall proceed to some Observations I have made upon the ascending Vessels in Oak, and other Wood.

In viewing the ascending Vessels in Oak, I found some other Vessels, which enter'd into their sides, and appear'd to me like so many small round holes, especially where the Horizontal Vessels lay, which I judg'd to be united to the ascending Vessels, by means of those small Orifices, and thereby to discharge part of their Sap into them.

Taking a small Twig of an Oak, which in seven Years growth was grown to about the thickness of ones Finger, I cut it thro' according to the length both of the ascending and horizontal Vessels, which last I saw lying in great Numbers very close together, and proceeding directly from the Pith of the Twig.

I have likewise made some Observations upon Fir Wood, in which the ascending Vessels consist of so very fine and thin a Substance, that they exhibit a very delightful Spectacle in the Microscope. In these ascending Vessels I imagin'd that I saw some Globules, with a small opening in their middle, which seem'd to be of a closer and denser Substance than the rest of the Wood. But I afterwards found myself mistaken, and that these supposed Globules were nothing else but the Orifices, whereby the ascending and horizontal Vessels were united together, and through which the Sap was carry'd from the one to the other.

From these Observations I turn'd my Thoughts to the fleshy Fibres of Animals, and began to consider with myself, that, since the Author of Nature usually observes the same Frame and Structure in a great variety of his Creatures, perhaps the fine Membranes, with which every Muscular Fibre is invested, and which are provided with an innumerable

erable multitude of small Vessels, might carry Nourishment in the same manner, thro' every carnos Fibre in a healthful Body.

In this view I cut off some very small thin Slices from the flesh of an Ox, directly across the length of the Fibres, and having placed them upon Glasses, and moistned them with clean Rain-water, I observ'd them with a very good Microscope, and continued viewing them so long, that the fleshy Fibres began to grow dry. I then saw, that in some Places the exceeding small and fine Vessels, which compounded the Membranes, wherewith the fleshy Fibres were enclosed, were broken off from the fleshy Fibres, by the unequal shrinking of the thin slice of Flesh upon the Plate of the Microscope. I saw at the same time some other of these small Vessels, which were something stronger than the former, and were not broken off from the fleshy Fibres, but yet were stretched and drawn from them to the distance of the Diameter of a Blood Globule. I saw likewise some fleshy Fibres, which adhered so close to other Fibres, that the small Vessels of Communication were not broken off or stretched, so that nothing was to be seen there, but only the Membrane encompassing the Fibres.

I likewise placed before the same Microscope several other carnos Fibres, which I had separated according to their length from the Flesh of an Ox. In each of these I observ'd a great number of extremely small Apertures, by which I judged that the small Vessels of the Membranes had enter'd the Fibres; which Vessels having been moistned with Water, as soon as the little moisture, which had

been left in those Apertures, was evaporated, I could see them very plain and distinct.

Now since of late there have been two Persons of note, who have maintain'd, that the Blood circulated thro' the carnous Fibres; in order to examine into the Truth of this Hypothesis, I prick'd my Thumb with a fine Needle, and placed a little Blood upon the Glass, where the carnous Fibres lay, with design to observe with my Microscope, what was the proportion between the Diameters of a Globule of Blood, and of the abovesaid Apertures, which I had seen in a Fibre.

While I was employ'd in these Observations, in came my Painter, who for these many Years has drawn all my Discoveries, and not being willing to trust too much to my own Eyes, he being much younger and better sighted than I, I placed before him the small Apertures in the Fibres, which he said were plain enough to be seen, and when he had view'd them to his satisfaction, I placed before him likewise the Globules of Blood, which lay together in great numbers, and yet so distinct and separate one from another, as one shall seldom see them. I then ask'd him, what he thought to be the proportion between the Diameter of a Globule of Blood, and the Diameter of one of those Apertures in a fleshy Fibre. After a little pause, he gave me for answer, that the Diameter of a Blood-Globule, was four times as large as the Diameter of one of those Apertures. If so, then according to the known Rule, a Globule of Blood must be divided into 64 parts, before it can enter through one of these Apertures into a fleshy Fibre.

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This discovery appear'd to me very wonderful; and I am apt to think, that it will be very difficult to penetrate any deeper into the hidden Structure of the muscular Fibres, and the manner by which they receive their Nourishment. I must confess that this Observation gave me an inward pleasure and satisfaction, which made me amends for some Reflections lately thrown upon me by a certain Foreign Gentleman, who, if this should come to his knowledge, would perhaps write to me again, as he did once before, that I related things which no Eye had ever seen.

Having committed these things to paper, my Thoughts ran again upon the muscular Fibres; and considering what I had said formerly concerning them, that they were composed of long, small Filaments, now I was not satisfy'd therewith, and therefore endeavour'd to discover, whether these small Filaments, which compose a carnosus Fibre, might not really be so many small Vessels. With this design, I took part of the flesh of a Whale, which I had kept some Years by me, and cut it into very thin Slices directly across the Fibres, and having moistned these thin Slices with fair Water, I placed them upon several Glasses, and before several Microscopes, when I observ'd that what I had formerly taken for small Threads or Filaments, were in reality exceeding small Vessels. I then cut part of the Whale's Flesh lengthwise, in order to discover the Vessels, which convey the nutritious Juice out of the Membranes into the muscular Fibres, which Vessels then appear'd to me in great plenty and very distinct.

I afterwards took another piece of the flesh of a very fat Ox, which I cut thro' transversly, and looking upon it with some of my best Microscopes,

I could plainly see, that how small soever these Fibres were, they were still vascular, for I could see the light thro' the apertures of these Vessels, as I had done before in those of a Whale; but if I happen'd to cut the Fibres never so little obliquely, instead of cutting them directly across their length, the light was not to be seen thro' them.

I had in a Drawer the hind Quarter of a Mouse, which had lain there some Years; from the largest Muscle of which I cut off transversely some small Slices, as thin as possibly I could. Then placing these before my Microscope, I not only saw, that the car-nous Fibres were of the same thickness with those of an Ox, but besides I could see the apertures of the Vessels composing the car-nous Fibres, as plainly as in the flesh of a Whale. The Vessels in the Muscular Fibres of a Whale, are indeed six times more in number, than in those of an Ox, or a Mouse, but then the Fibre of a Whale is also six times as thick as the other.

Hereupon I consider'd after what manner the Vessels, of which the muscular Fibres mostly consist, receiv'd their nourishment from the Vessels of the Membranes; since the muscular Fibres, when they are at rest, have many alternate corrugations, by which I judged, that the Vessels in the Fibres must have their sides press'd together, and their cavities closed up. But if we call to mind, that in walking a Man may move both his Feet above 3600 times in an Hour, (for he may make two steps in the time of one pulsation of the Artery,) and that in that space of an Hour the muscular Fibres must be so many times extended and contracted, and will therefore require great Supplies; we shall likewise find that this is sufficiently

ciently provided for, since upon every extension of the Muscle the apertures of those small Vessels are free and open for the carriage of Nourishment into the Fibres. This wonderful structure of the Membranes, and the vast number of Vessels they consist of, as likewise the small Vessels of which the muscular Fibres are composed, has never yet to my knowledge enter'd into the Thoughts of any Man, and with many will hardly find Credit. Perhaps they will say, they have as good Glasses as I, and yet cannot see what I have related.

I am, &c.

P. S. I humbly desire that what I have here said, may be receiv'd with your usual Candour, and that a favourable allowance may be made for my great Age. A certain Gentleman, who was with me some Months ago, intreated me to go on in making Observations, adding that the Fruit which ripen'd in Autumn, was the most lasting. This is now the Autumn of my Life, I being arriv'd to the age of $88\frac{1}{2}$ Years, and having committed these Observations to Paper in the Months of *November* and *December* last.